SECTION 5: UNIT REPLACEMENT AND RESTORATION COSTS OF DAMAGED AIRCRAFT

5.1 INTRODUCTION

The cost of damage to aircraft in aviation accidents is borne directly by operators and indirectly by users and society in the form of higher fares and taxes. Determining these costs provides a measure for evaluation of FAA investment and regulatory programs that affect the likelihood of aircraft being damaged or destroyed.

5.1.1 Replacement

For the purpose of evaluating the cost of aircraft replacement, a destroyed aircraft is assigned the value of an identical or nearly identical aircraft. This valuation assumption is consistent with the opportunity cost of the loss of the use of a typical aircraft; the value of a new aircraft would overstate the typical loss. The aircraft values reported below are based on transactions in the well-defined market for used aircraft, except for military aircraft which will be discussed later in this section.

5.1.2 Restoration

The NTSB classifies aircraft involved in accidents as "destroyed," having "substantial damage," having "minor damage," or having "no damage."

The cost incurred as a result of "minor damage" to aircraft is generally a negligible percentage of the market value and is not evaluated in this report. An aircraft with "substantial damage" is one that is damaged but repairable; industry data discussed below provide a means of estimating the relative relationship between the cost of damage and the total value of the aircraft.

5.2 AIR CARRIER AIRCRAFT

5.2.1 Replacement

Replacement values were derived from a proprietary database developed by GRA Aviation Specialists (GRAS).[1] The first step in establishing average fleet valuation is to develop an industry database covering each aircraft and aircraft type in the U.S. fleet. The average value was developed using an estimated value for each aircraft delivered in a given year, and then aggregating these values into the economic classifications.

[1] GRA Aviation Specialists, 690 Center Street, Suite 203, Herndon, VA 20170.

The valuation database uses industry data on recent sales and asking prices of airplanes on the used market. There is an active market in used commercial aircraft, and thus it is possible to obtain reliable estimates of the opportunity cost of destroyed aircraft.

The summary of values for commercial aircraft is shown in Table 5-1, and detail by equipment type is shown in Table 5-9. The first column shows an average value by aircraft type. As a measure of value dispersion, the second column provides the standard deviation of aircraft values within the groups. The last row provides an estimate of average value for the fleet estimated using the values in Column 1 and weighting them by annual hours; this value pertains to the average value of commercial aircraft observed in the air traffic system.

Table 5-1
Average Commercial Aircraft Values
(Averages Weighted by Fleet)

Economic Values Class	(Column 1) Average Value ($000,000)	(Column 2) SD A/C Value ($000,000)	(Column 3) Fleet Size	(Column 4) Average Restoration Value ($000,000)
Two-engine narrow body passenger	$17.87	$12.28	3,049	$2.41
Two-engine narrow body freight	4.83	1.47	28	$0.65
Two-engine wide body passenger	46.45	26.96	322	$6.27
Two-engine wide body freight	51.15	26.54	66	$6.91
Three-engine narrow body passenger	3.31	2.22	689	$0.45
Three-engine narrow body freight	3.17	2.15	285	$0.43
Three-engine wide body passenger	14.83	23.22	346	$2.00
Three-engine wide body freight	40.75	32.38	73	$5.50
Four-engine narrow body passenger	4.50	2.8	108	$0.61
Four-engine narrow body freight	9.92	7.27	195	$1.34
Four-engine wide body passenger	36.11	43.86	155	$4.87
Four-engine wide body freight	23.23	12.33	70	$3.14
Regional jet under 40 seats	NR	NR	NR	NR
Regional jet with 40-59 seats	15.98	1.35	72	$2.16
Regional jet over 59 seats	NR	NR	NR	NR
Turboprops under 20 seats	1.75	1.27	929	$0.24
Turboprops under 20 seats freight	0.88	0.07	242	$0.12
Turboprops with 20 or more seats	3.84	2.89	1,540	$0.52
Piston	NR	NR	NR	NR
All Aircraft (weighted by fleet)	$12.58	17.14	8,169	$1.70
All Aircraft (weighted by hours)	$15.93	NA	NA	$2.15

NR = No data reported.

NA = Not applicable.

Source: GRA Aviation Specialists (GRAS) 690 Center Street, Suite 203, Herndon, VA 20170

Col 1: Total value of aircraft in class, divided by fleet (Col 3).

Col 2: Standard deviation value of the average in Col 1.

Col 3: Total fleet in the class.

Col 4: Average restoration percentage (13.5%) multiplied by Col. 1.

5.2.2 Restoration

Restoration costs were estimated for commercial air carriers by analysis of the CASE database developed by Airclaims, Inc.[2] The database covers all commercial accidents throughout the world, and includes the insured hull value of the aircraft and the value of the claim. Aircraft that were destroyed were excluded from the analysis, as the replacement cost is clear in that case. Minor losses, where the loss percentage was under two percent, were also excluded. This level of loss is assumed to place the loss as an incident rather than an accident. Analysis of the data indicated that the average cost of repair was 13.5 percent of the insured value. This percentage is used for all commercial aircraft.[3] The estimated average restoration cost by aircraft type is shown in Column 4 of Table 5-1.

5.3 GENERAL AVIATION AIRCRAFT

5.3.1 Replacement

Replacement values for general aviation aircraft were based on a methodology similar to that used for commercial air carriers. The primary source of data was the *Aircraft Bluebook - Price Digest (Spring 1997)*.[4] Aircraft in the fleet were assigned to one of the 23 economic value classifications. The average age of all aircraft of a particular type was calculated based on detailed data from the *General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1995*.[5] The value for the average aircraft for each type was identified from the "Bluebook;" these averages were used together with the relative numbers of aircraft of each type in a particular Economic Value Class to obtain a weighted average value for that class.

The summary of valuation for general aviation classes is shown in Table 5-2. This valuation is provided in terms of an average value per aircraft, a minimum and maximum value per aircraft, and a statistical standard derivation that applies to the average value. Table 5-2 is shown in three parts for aircraft built before 1982, for aircraft built in 1982 and beyond, and for all aircraft. Detail by major aircraft type is shown in Table 5-10. No data were available in certain aircraft categories.

There have been significant changes in the composition of the general aviation fleet since the early 1980's which makes it desirable to have additional information on aircraft values. There was a major decline in GA aircraft production—primarily smaller piston aircraft—after 1981. The fleet age profile for smaller piston aircraft is significantly different than that for larger turbine aircraft. Moreover, there is wide variation in the values of pre- and post-1982 aircraft. As was noted previously, no data were available in certain aircraft categories. As a result, average values are less relevant for at least some economic evaluations. For example, FAA may be faced with

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[2] Airclaims Group, Ltd., London Heathrow Airport, England.

[3] Insufficient data were available to develop reliable samples for rates that would apply to detailed equipment types.

[4] *Aircraft Bluebook – Price Digest*, (Overland Park, KS: Intertec Publishing, Spring 1997).

[5] *General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1995*, FAA-APO-97-4 (Washington, DC, 1997). The analysis here used the actual sample records and appropriate expansion factors.

investment or regulatory decisions that disproportionately affect GA piston or GA turbine operators. In extreme cases, these decisions may affect only one group or the other. Or decisions may affect aircraft of only certain ages, such as a requirement to bring an old design up to a modern standard. The values relevant for use in such a benefit-cost study should reflect the aircraft actually affected. One way to reflect such value differences is to use either pre-1982 or post-1982 data depending upon which is most representative.

Table 5-3 shows the values of general aviation aircraft separated into air taxi and all other uses; air taxi aircraft are assumed to be those used primarily (50 percent or more of the hours) for hire service as reported in the detailed data used in the *General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1995*.[6] Table 5-3 also shows all other aircraft and the total fleet. The aircraft used in air taxi (as a group) are of considerably higher value than the other aircraft in the general aviation fleet.

In both tables 5-2 and 5-3, the last row shows average values weighted by flight hours. These values correspond to the average aircraft flown in the air traffic system, and are based on numbers in Column 1 weighted by flight hours in each economic value class.

In some cases, aircraft value estimates were not available because of small numbers of aircraft in the fleet group. While it is a large group, no replacement costs could be developed for class 23 (experimental, home built, and other) aircraft. Aircraft in this group have a somewhat limited used aircraft market, and values for this class of aircraft are highly variable.

5.3.2 Restoration

Information is available from the CASE database[7] on the restoration costs for part of the general aviation fleet. Data are available on claimed damages and insured hull value for large air carrier aircraft and some corporate aircraft, especially business jets. Using this information and data from previous studies, estimates for restoration costs for each aircraft group were developed. The available Airclaims data are used to derive a value of 16.4 percent for the GA turbojet/ turbofan groups. The turbojet/fan value from Airclaims is also applied to turboprops and turboshaft helicopters. Second, the values from the 1989 study[8] for single engine piston (29%) and twin engine piston (24%) aircraft are applied in this study. As was the case in the 1989 study, piston rotorcraft are assigned the same restoration percentages as single engine piston fixed wing aircraft (29%). The restoration percentages are shown in Table 5-4. For estimates of restoration values by aircraft type, see Table 5-5.

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[6] *General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1995, op.cit.*

[7] Airclaims Group, Ltd., *op. cit.*

[8] *Economic Values for Evaluation of Federal Aviation Administration Investment and Regulatory Programs*, FAA-APO-89-10, (Washington, DC: October, 1989).

Table 5-2

General Aviation Aircraft Values

Year Built -->		Pre-1982					1982 and Beyond					All Years				
	Economic Values Class	(Column 1a) Fleet Size	(Column 2a) Average Value Per Aircraft ($000)	(Column 3a) Minimum Value Per Aircraft ($000)	(Column 4a) Maximum Value Per Aircraft ($000)	(Column 5a) Standard Deviation ($000)	(Column 1b) Fleet Size	(Column 2b) Average Value Per Aircraft ($000)	(Column 3b) Minimum Value Per Aircraft ($000)	(Column 4b) Maximum Value Per Aircraft ($000)	(Column 5b) Standard Deviation ($000)	(Column 1c) Fleet Size	(Column 2c) Average Value Per Aircraft ($000)	(Column 3c) Minimum Value Per Aircraft ($000)	(Column 4c) Maximum Value Per Aircraft ($000)	(Column 5c) Standard Deviation ($000)
									21	755						
1	Piston 1-3 Seats	41,160	23	11	188	26	2,400	139	44	495	188	43,560	27	11	755	44
2	Piston 4-9 Seats 1 Eng	83,345	52	14	450	61	5,576	158	19	440	184	88,921	58	14	495	74
3	Piston 4-9 Seats 2 Eng	15,315	141	30	464	179	1,062	239	NR	NR	273	16,378	147	19	464	187
4	Piston 10-19 Seats 1 Eng	1	NR	NR	NR	NR	NR	NR	0	0	NR	1	NR	NR	NR	NR
5	Piston 10-19 Seats 2 Eng	400	156	69	440	177	69	0	0	0	0	469	156	69	440	177
6	Piston 20+ Seats 2 Eng	135	163	163	163	161	0	0	NR	NR	0	135	163	163	163	161
7	Piston 20+ Seats 4 Eng	51	NR	NR	NR	NR	NR	NR	175	1,450	NR	51	NR	NR	NR	NR
8	Turboprop 1-9 Seats 1 Eng	125	227	175	245	227	647	720	618	1,285	806	772	672	175	1,450	769
9	Turboprop 1-9 Seats 2 Eng	967	517	260	618	524	196	1,047	905	2,100	1,067	1,163	614	260	1,285	658
10	Turboprop 10-19 Seats 1 Eng	6	NR	NR	NR	NR	25	1,522	584	3,800	1,583	25	1,522	905	2,100	1,583
11	Turboprop 10-19 Seats 2 Eng	1,593	794	150	1,050	824	860	1,710	1,055	4,690	1,848	2,453	1,109	150	3,800	1,273
12	Turboprop 20+ Seats 2 Eng	64	784	650	885	766	104	2,810	NR	NR	3,299	168	2,531	650	4,690	3,081
13	Turboprop 20+ Seats 4 Eng	0	NR	NR	NR	NR	0	NR	1,150	8,900	NR	0	NR	NR	NR	NR
14	Turbojet/fan 2 Eng <20,000	1,321	1,321	345	2,200	1,419	1,665	4,283	1,900	21,000	4,709	2,986	3,017	345	8,900	3,683
15	Turbojet/fan 2 Eng >=20,000	651	2,526	405	8,500	3,259	621	14,698	0	0	16,043	1,272	9,262	405	21,000	12,128
16	Turbojet/fan 3+ Eng <20,000	0	0	0	0	0	2	0	18,700	18,700	0	2	0	0	0	0
17	Turbojet/fan 3+ Eng >=20,000	84	1,539	380	2,200	1,732	108	18,700	4,630	36,630	18,532	193	10,985	380	18,700	13,772
18	Turbojet/fan >=65,000	108	1,804	750	6,600	1,966	88	17,348	56	148	17,934	196	7,099	750	36,630	10,619
19	Rotor Piston <7,000	850	65	18	87	68	605	89	129	3,150	91	1,455	76	18	148	79
20	Rotor Turbine <7,000	1,304	376	79	700	392	954	548	0	0	633	2,257	449	79	3,150	508
21	Rotor Piston >=7,000	42	70	70	70	68	0	0	620	4,800	0	42	70	70	70	68
22	Rotor Turbine >=7,000	586	1,006	510	1,600	1,071	941	1,794	NR	NR	2,258	1,527	1,643	510	4,800	2,084
23	Other	5,594	NR	NR	NR	NR	11,722	NR			NR	17,316	NR	NR	NR	NR
									36,630	4,219						
All Aircraft		153,703	96	11	8,500	285	27,638	1,642	19	36,630	4,219	181,341	251	11	36,630	1,310
All Aircraft (hours)		NA	148	NA	NA	NA	NA	2,091	NA	NA	NA	NA	520	NA	NA	NA

Source: FAA GA Survey and Aircraft Bluebook - Price Digest.
NR = No data reported.
NA = Not applicable.
Note: Zero indicates no sample aircraft in that class and use.
Col 1: Fleet size.
Col 2: Average value of aircraft in category.
Col 3: Minimum value of aircraft in category.
Col 4: Maximum value of aircraft in category.
Col 5: Statistical standard derivation for values in category.

Table 5-3

General Aviation Aircraft Values

	Economic Values Class	Air Taxi (Column 1a) Fleet Size	Air Taxi (Column 2a) Average Unit Value ($000)	Air Taxi (Column 3a) Minimum Value Per Aircraft ($000)	Air Taxi (Column 4a) Maximum Value Per Aircraft ($000)	Air Taxi (Column 5a) Standard Deviation ($000)	General Aviation (Column 1b) Fleet Size	General Aviation (Column 2b) Average Unit Value ($000)	General Aviation (Column 3b) Minimum Value Per Aircraft ($000)	General Aviation (Column 4b) Maximum Value Per Aircraft ($000)	General Aviation (Column 5b) Standard Deviation ($000)	Total Fleet (Column 1c) Fleet Size	Total Fleet (Column 2c) Average Unit Value ($000)	Total Fleet (Column 3c) Minimum Value Per Aircraft ($000)	Total Fleet (Column 4c) Maximum Value Per Aircraft ($000)	Total Fleet (Column 5c) Standard Deviation ($000)
1	Piston 1-3 Seats	0	0	0	0	0	43,560	27	11	755	44	43,560	27	11	755	44
2	Piston 4-9 Seats 1 Eng	224	105	46	450	145	88,697	58	14	495	74	88,921	58	14	495	74
3	Piston 4-9 Seats 2 Eng	906	173	76	315	184	15,472	145	19	464	187	16,378	147	19	464	187
4	Piston 10-19 Seats 1 Eng	0	NR	NR	NR	NR	1	NR	NR	NR	NR	1	NR	NR	NR	NR
5	Piston 10-19 Seats 2 Eng	229	171	69	440	191	240	80	69	113	80	469	156	69	440	177
6	Piston 20+ Seats 2 Eng	64	163	163	163	161	71	163	163	163	157	135	163	163	163	161
7	Piston 20+ Seats 4 Eng	0	NR	NR	NR	NR	51	NR	NR	NR	NR	NR	NR	NR	NR	NR
8	Turboprop 1-9 Seats 1 Eng	281	910	910	910	908	491	424	175	1,450	589	772	672	175	1,450	769
9	Turboprop 1-9 Seats 2 Eng	0	0	0	0	0	1,163	614	260	1,285	658	1,163	614	260	1,285	658
10	Turboprop 10-19 Seats 1 Eng	12	0	0	0	0	13	2,100	2,100	2,100	2,011	25	1,522	905	2,100	2,011
11	Turboprop 10-19 Seats 2 Eng	185	677	275	1,300	692	2,268	1,147	150	3,800	1,311	2,453	1,109	150	3,800	1,273
12	Turboprop 20+ Seats 2 Eng	18	0	0	0	0	150	2,531	650	4,690	3,081	168	2,531	650	4,690	3,081
13	Turboprop 20+ Seats 4 Eng	0	NR	NR	NR	NR	0	NR	NR	NR	NR	0	NR	NR	NR	NR
14	Turbojet/fan 2 Eng <20,000	111	1,129	575	2,200	1,202	2,875	3,095	345	8,900	3,749	2,986	3,017	345	8,900	3,683
15	Turbojet/fan 2 Eng >=20,000	7	505	505	505	468	1,266	9,315	405	21,000	12,166	1,272	9,262	405	21,000	12,128
16	Turbojet/fan 3+ Eng <20,000	0	0	0	0	0	2	0	0	0	0	2	0	0	0	0
17	Turbojet/fan 3+ Eng >=20,000	0	0	0	0	0	193	10,985	380	18,700	13,772	193	10,985	380	18,700	13,772
18	Turbojet/fan >=65,000	0	0	0	0	0	196	7,099	750	36,630	10,619	196	7,099	750	36,630	10,619
19	Rotor Piston <7,000	0	0	0	0	0	1,455	76	18	148	79	1,455	76	18	148	79
20	Rotor Turbine <7,000	92	996	311	3,150	1,129	2,166	426	79	1,475	463	2,257	449	79	3,150	508
21	Rotor Piston >=7,000	0	0	0	0	0	42	70	70	70	68	42	70	70	70	68
22	Rotor Turbine >=7,000	162	1,554	1,250	2,610	1,568	1,365	1,654	510	4,800	2,143	1,527	1,643	510	4,800	2,084
23	Other	1	NR	NR	NR	NR	17,315	NR	NR	NR	NR	17,316	NR	NR	NR	NR
	All Aircraft	2,291	479	46	3,150	669	179,050	248	11	36,630	1,317	181,341	251	11	36,630	1,310
	All Aircraft (hours)	NA	648	NA	NA	NA	NA	515	NA	NA	NA	NA	520	NA	NA	NA

Source: FAA GA Survey and Aircraft Bluebook - Price Digest. Air taxi defined as aircraft with dominant use in air taxi hours.
NR = No data reported.
NA = Not applicable.
Note: Zero indicates no sample aircraft in that class and use.
Col 1: Fleet size.
Col 2: Average value of aircraft in category.
Col 3: Minimum value of aircraft in category.
Col 4: Maximum value of aircraft in category.
Col 5: Statistical standard derivation for values in category.

Table 5-4

Restoration Cost of Damaged Aircraft as a Percent of Aircraft Replacement Cost

Aircraft Type	Restoration Percentage
Fixed Wing:	
Air Carrier Aircraft	13.5%
General Aviation Aircraft	
Piston – Single Engine	29.0%
Piston – Twin Engine	24.0%
Turboprop	16.4%
Turbojet/fan	16.4%
Rotorcraft:	
Piston	29.0%
Turbine	16.4%

Table 5-5

General Aviation Aircraft Values and Restoration Costs

		Air Taxi			GA			Total Fleet		
	Economic Values Class	(Column 1a) Fleet Size	(Column 2a) Average Unit Value ($000)	(Column 3a) Restoration Costs ($000)	(Column 1b) Fleet Size	(Column 2b) Average Unit Value ($000)	(Column 3b) Restoration Costs ($000)	(Column 1c) Fleet Size	(Column 2c) Average Unit Value ($000)	(Column 3c) Restoration Costs ($000)
1	Piston 1-3 Seats	0	NA	NA	43,560	27	8	43,560	27	8
2	Piston 4-9 Seats 1 Eng	225	105	30	88,696	58	17	88,921	58	17
3	Piston 4-9 Seats 2 Eng	907	173	41	15,471	145	35	16,378	147	35
4	Piston 10-19 Seats 1 Eng	0	NA	NA	1	NR	NR	1	NR	NR
5	Piston 10-19 Seats 2 Eng	221	169	41	248	68	16	469	136	33
6	Piston 20+ Seats 2 Eng	64	163	39	71	163	39	135	163	39
7	Piston 20+ Seats 4 Eng	0	NA	NA	51	NR	NR	51	NR	NR
8	Turboprop 1-9 Seats 1 Eng	289	910	149	484	430	71	772	679	111
9	Turboprop 1-9 Seats 2 Eng	0	NA	NA	1,163	572	94	1,163	572	94
10	Turboprop 10-19 Seats 1 Eng	13	905	148	12	2,100	344	25	1,522	250
11	Turboprop 10-19 Seats 2 Eng	183	678	111	2,270	1,136	186	2,453	1,100	180
12	Turboprop 20+ Seats 2 Eng	18	NA	NA	150	2,487	408	168	2,487	408
13	Turboprop 20+ Seats 4 Eng	0	NA	NA	0	NA	NA	NA	NA	NA
14	Turbojet/fan 2 Eng <20,000	110	1,129	185	2,877	3,091	507	2,986	3,015	494
15	Turbojet/fan 2 Eng >=20,000	7	505	83	1,266	9,297	1,525	1,272	9,244	1,516
16	Turbojet/fan 3+ Eng <20,000	0	NA	NA	2	NR	NR	2	NR	NR
17	Turbojet/fan 3+ Eng >=20,000	0	NA	NA	193	10,612	1,740	193	10,612	1,740
18	Turbojet/fan >=65,000	0	NA	NA	196	6,782	1,112	196	6,782	1,112
19	Rotor Piston <7,000	0	NA	NA	1,455	76	22	1,455	76	22
20	Rotor Turbine <7,000	92	996	163	2,166	426	70	2,257	448	73
21	Rotor Piston >=7,000	0	NA	NA	42	70	20	42	70	20
22	Rotor Turbine >=7,000	165	1,555	255	1,362	1,664	273	1,527	1,651	271
23	Other	2	NA	NA	17,314	NA	NA	17,316	NA	NA
All Aircraft		2,293	484	88	179,048	246	46	181,341	250	47

Source: FAA GA Survey and *Aircraft Bluebook - Price Digest* . Air taxi defined as aircraft with dominant use in air taxi hours.

NA=Not Applicable.

NR = No data reported.

Notes: Zero indicates no sample aircraft in that class and use. Totals may not add due to rounding.

Col 1: Fleet size.

Col 2: Average value of aircraft in category.

Col 3: Values for restoration percentages from Table 5-4 applied to values in Column 2.

5.4 MILITARY AIRCRAFT

5.4.1 Replacement

Estimating replacement values for military aircraft is considerably more complex than it is for air carrier or general aviation aircraft. One problem is that used military aircraft do not sell in the large numbers that commercial equipment does. The second problem is that there is a complex procurement process for military aircraft, which often makes unit cost estimates for individual types inappropriate as measures of opportunity costs.

The example of the B-52 bomber illustrates the two problems discussed above. First, there is no used market for this aircraft. It is a venerable aircraft, for which there are few substitutes. Second, what would it cost to actually replace a plane that is lost in an accident? It is not possible to buy one B-52 or a newer plane that has similar characteristics. A new military procurement program would cost a substantial sum of money, which could not be counted as a cost against one plane lost in an accident.

The only practical solution is to count the value of military aircraft as the approximate cost of a new aircraft where that model is still being produced, or the cost of older aircraft, brought up to date for inflation. The general method used here is to assign the value of military aircraft as a result of the following steps:

1. If an aircraft type is still being produced, the latest price information is used.

2. If an aircraft is no longer in production, but there is a commercial aircraft that would serve the same general military purpose, the value of the comparable commercial aircraft is applied.

3. If an aircraft type is no longer in production, the latest price paid is determined and prices are brought up to current dollar values using the PPI inflation rate discussed below.

4. If none of the above valuations estimates were possible, the value shown in the 1989 study is used, updated to the current costs to account for inflation, using the PPI rate discussed below.

With respect to number 1 above, sources included recent budget data as summarized in the *Aviation and Aerospace Almanac*, 1996.[9] With respect to number 2, data from the GRAS[10] database were used. With respect to number 3, the primary source was *Jane's All the World's Aircraft*.[11] For the remainder of the aircraft, mostly older aircraft, the 1989 study values[12] were

[9] *Aviation and Aerospace Almanac* (Washington, DC: Aviation Week Group Newsletters, 1996).
[10] GRA Aviation Specialists, *op. cit.*
[11] *Jane's All the World's Aircraft* (Surrey, U.K.: Jane's Information Group Limited, various years).
[12] The sources of these values are shown in the 1989 study at p. 84, and are virtually the same as the sources used in this update.

updated for inflation using the PPI Detailed Report for aircraft from the U.S. Department of Labor.[13]

The summary of valuation by general type is provided in Table 5-6. Fleet data are year-end 1996 data, as summarized in *The Aerospace Source Book*.[14] Detail data by aircraft type are shown in Supporting Table 5-11.

5.4.2 Restoration

Data on military restoration costs were not available. The percentage from the Airclaims database for commercial air carriers is used by analogy for military aircraft. Restoration estimates for military aircraft are shown in Table 5-6 with detail provided in Table 5-11.

Table 5-6
Summary of Military Fleet—December 1996
(Averages Weighted By Fleet Size)

Economic Values Class	(Column 1) Fleet Size	(Column 2) Avg. A/C Value ($000,000)	(Column 3) Restoration ($000,000)
Turbojet/fan 3+engines	1,250	90.98	12.28
Turbojet/fan Attack/Fighter	4,663	31.86	4.30
Turbojet/fan Other	1,674	7.83	1.06
Turboprop	2,371	29.67	4.01
Piston Engine	91	0.12	0.02
Fixed Wing Total	10,049	34.26	4.62
Rotary Aircraft Total	10,354	8.36	1.13
Total Military Fleet	20,403	21.11	2.85

Source: See text at Section 5.4.1.
Col 1: Number of aircraft in total of military services.
Col 2: Estimated total value divided by fleet.
Col 3: Average restoration value, or Column 2 average value multiplied by 13.5 percent.

5.5 FLEET VALUATION RELATED TO STAGE 2 AND STAGE 3 REQUIREMENTS

Analysts who are using fleet average data over intermediate or long time periods should bear in mind the potential impacts of the Stage 3 noise rules. These rules require that large aircraft meet Stage 3 standards by the end of 1999. Airlines face important decisions whether to retrofit Stage 2 aircraft or acquire complying aircraft by the end of 1999. Their decisions will

[13] The PPI detailed report lists producer price indices for products by SIC code. The PPI for aircraft (SIC-3721) was used.
[14] *The Aerospace Source Book*, (Washington, DC: McGraw-Hill, January 13, 1997).

affect the average values of aircraft that should be used in FAA regulatory and investment analysis.

At the end of 1996, 2,034 of the 8,169 commercial aircraft in the U.S. air carrier fleet were narrow body and Stage 2. All of these aircraft are considered eligible for conversion to Stage 3 because a hushkit was available for converting them. In addition, many widebodies—e.g., early B-747's, L1011's and DC-10's—were Stage 2 aircraft but all of them can be brought into compliance by reducing gross weight of operations, by using different flap settings on takeoff, or through other operational changes.

In order to estimate the impact of the noise rule on the fleet, the following assumptions were made:

- All Category 2 wide body aircraft will remain in the fleet and adopt revised operational procedures to meet Stage 3
- Half of the narrow body fleet eligible for conversion will not be converted, and
- The oldest half of the fleet eligible for conversion will be dropped from the fleet.

The first assumption is based on the observation that few wide body aircraft have been retired to meet intermediate Stage 2 requirements because the operational penalties are not a large factor for most missions flown by these aircraft, and/or the cost of alternative Stage 3 versions is large relative to the modest cost of the operational penalty. The second assumption above is based on an analysis done by the Boeing Aircraft Company and incorporated in their annual forecast.[15] The third assumption is a practical one, based on the observation that the older an airplane, the lower its comparative value; all other things equal, newer aircraft with longer expected future lives will make the most economic sense to modify.

Table 5-7 reports the average 1996 values for the projected Stage 3 fleet in the year 2000. For all aircraft assumed to meet Stage 3 requirements through the installation of a hushkit, the market value of the aircraft has been enhanced by the cost of the hushkit. This is the standard adopted by aircraft valuation firms.[16]

5.6 PROFILES

Table 5-8A and 5-8B summarize the replacement costs and restoration costs of scheduled commercial, non-scheduled commercial and non-commercial user groups. Table 5-8A expresses results weighted by aircraft units, while Table 5-8B presents results weighted by hours.

[15] *1997 Current Market Outlook*, (Seattle, WA: Boeing Commercial Airplane Company, 1997).
[16] GRA Aviation Specialists, Inc., *op. cit.*

Table 5-7

Values of Current Fleet Projected To Be Stage 3 Compliant in the Year 2000

1996 Dollars

Circa 1996 Fleet							
	Hushkit Aircraft		Stage 3 Aircraft		Stage 3 Compliant Aircraft		
	(Column 1)	(Column 2)	(Column 3)	(Column 4)	(Column 5)	(Column 6)	(Column 7)
Economic Values Class	Average Value	Fleet	Average Value	Fleet	Average Value	Fleet	Average Restoration Value
Two-engine narrow body passenger	$7.93	395	$23.58	2,198	$21.20	2,593	$2.86
Two-engine narrow body freight	$7.24	13	NR	NR	$7.24	13	$0.98
Two-engine wide body passenger	NA	NA	$46.45	322	$46.45	322	$6.27
Two-engine wide body freight	NA	NA	$51.15	66	$51.15	66	$6.91
Three-engine narrow body passenger	$4.89	491	NR	NR	$4.89	491	$0.66
Three-engine narrow body freight	$6.75	112	NR	NR	$6.75	112	$0.91
Three-engine wide body passenger	NA	NA	$14.83	346	$14.83	346	$2.00
Three-engine wide body freight	NA	NA	$40.75	73	$40.75	73	$5.50
Four-engine narrow body passenger	$3.65	2	$10.55	30	$10.12	32	$1.37
Four-engine narrow body freight	$5.85	4	$17.34	92	$16.86	96	$2.28
Four-engine wide body passenger	NA	NA	$36.11	155	$36.11	155	$4.87
Four-engine wide body freight	NA	NA	$23.23	70	$23.23	70	$3.14
Regional jet under 40 seats	NR	NR	NR	NR	NR	NR	NR
Regional jet with 40-59 seats	NA	NA	$15.98	72	$15.98	72	$2.16
Regional jet over 59 seats	NR	NR	NR	NR	NR	NR	NR
Turboprops under 20 seats	NA	NA	$1.75	929	$1.75	929	$0.24
Turboprops with 20 or more seats	NA	NA	$3.84	1,540	$3.84	1,540	$0.52
Piston	NR	NR	NR	NR	NR	NR	NR
All Aircraft	$6.31	1,017	$16.31	5,893	$14.83	6,910	$2.00

NA = Not applicable.

NR = No data reported.

Source: GRA Aviation Specialists, Herndon, VA

Col 1: Total value (including cost of hushkit) of Stage 2 aircraft whose vintage is in the upper half among all Stage 2 narrowbody aircraft divided by fleet (Col 2).

Col 2: Number of Stage 2 aircraft whose vintage is in the upper half among all Stage 2 narrow body aircraft.

Col 3: Total value of Stage 3 aircraft (including Stage 2 wide body aircraft that can be Stage 3 compliant by altering operational procedures) divided by fleet (Column 4).

Col 5: Total value of Column 1 and Column 3 aircraft divided by fleet numbers from Column 2 and Column 4.

Col 6: Column 2 plus Column 4.

Col 7: Values from Table 5-4 applied to economic value classes.

Table 5-8A
Unit Replacement Profiles
(Weighted by Aircraft Units)

User Class	(Column 1) Average Unit Value ($000,000)	(Column 2) Fleet Size	(Column 3) (11) Average Restoration Value ($000,000)
Scheduled Commercial Services			
Passenger (1)	$12.71	7,210	$1.72
Freight Only (2)	$11.64	959	$1.57
All Combined	$12.58	8,169	$1.70
Air Carrier Without Commuters			
Passenger (3)	$17.76	4,669	$2.40
Freight Only (4)	$15.27	717	$2.06
All Combined	$17.43	5,386	$2.35
Commuter Only			
Passenger (5)	$3.42	2,541	$0.46
Freight Only (6)	$0.88	242	$0.12
All Combined	$3.20	2,783	$0.43
Non-Scheduled Commercial (Air Taxi) (7)	$0.48	2,293	$0.09
Non-Commercial (GA and Military)			
GA and Air Taxi (8)	$0.25	181,341	$0.04
GA Only (9)	$0.25	179,048	$0.04
Military (10)	$21.10	20,403	$2.85

(1) Total value of all aircraft classified as passenger aircraft divided by total number of passenger aircraft.

(2) Total value of all aircraft classified as freight aircraft divided by total number of freight aircraft.

(3) Total value of all aircraft classified as Air Carrier passenger aircraft divided by total number of Air Carrier passenger aircraft. Air Carrier aircraft are identified as jet powered aircraft that are not regional jets.

(4) Total value of all aircraft classified as Air Carrier freight aircraft divided by total number of Air Carrier freight aircraft. Air Carrier aircraft are identified as jet powered aircraft that are not regional jets.

(5) Total value of all aircraft classified as commuter passenger aircraft divided by total number of commuter passenger aircraft. Commuter aircraft are identified as regional jets and turboprop aircraft.

(6) Total value of all aircraft classified as commuter freight aircraft divided by total number of commuter freight aircraft. Commuter aircraft are identified as regional jets and turboprop aircraft.

(7) Air taxi aircraft are defined as those GA aircraft used at least 50 percent of the time in air taxi service (see Table 5-3).

(8) Includes all GA aircraft (see Table 5-2).

(9) Includes all GA aircraft except those qualifying as air taxi (see Note 7).

(10) Includes all military aircraft (see Table 5-5).

(11) Values for Table 5-4 applied to user class categories.

Table 5-8B
Unit Replacement Profiles
(Weighted by Airborne Hours)

User Class	(Column 1) Average Unit Value ($000,000)	(Column 2) Airborne/ Flight Hours	(Column 3) (11) Average Restoration Value ($000,000)
Scheduled Commercial Services			
Passenger (1)	$16.07	14,269,090	$2.17
Freight Only (2)	$14.28	1,177,482	$1.93
All Combined	$15.93	15,446,572	$2.15
Air Carrier Without Commuters			
Passenger (3)	$19.15	11,476,924	$2.59
Freight Only (4)	$17.63	947,672	$2.38
All Combined	$19.04	12,424,596	$2.57
Commuter Only			
Passenger (5)	$3.81	2,792,166	$0.51
Freight Only (6)	$0.88	229,810	$0.12
All Combined	$3.66	3,021,976	$0.49
Non-Scheduled Commercial (Air Taxi) (7)	$0.65	1,514,623	$0.14
Non-Commercial (GA and Military)			
GA and Air Taxi (8)	$0.52	25,447,963	$0.13
GA Only (9)	$0.51	23,933,340	$0.13
Military (10)	NR	NR	NR

NR = No data reported.

(1) Average value of aircraft classified as passenger aircraft weighted by passenger aircraft airborne hours.

(2) Average value of aircraft classified as freight aircraft weighted by freight aircraft airborne hours.

(3) Average value of aircraft classified as Air Carrier passenger aircraft weighted by Air Carrier passenger aircraft airborne hours. Air Carrier aircraft are identified as jet powered aircraft that are not regional jets.

(4) Average value of aircraft classified as Air Carrier freight aircraft weighted by number of Air Carrier freight aircraft airborne hours. Air Carrier aircraft are identified as jet powered aircraft that are not regional jets.

(5) Average value of aircraft classified as commuter passenger aircraft weighted by commuter passenger aircraft airborne hours. Commuter aircraft are identified as regional jets and turboprop aircraft.

(6) Average value of all aircraft classified as commuter freight aircraft weighted by commuter freight aircraft airborne hours. Commuter aircraft are identified as regional jets and turboprop aircraft.

(7) Air taxi aircraft are defined as those GA aircraft used at least 50 percent of the time in air taxi service (see Table 5-3).

(8) Includes all GA aircraft (see Table 5-2).

(9) Includes all GA aircraft except those qualifying as air taxi (see Note 7).

(10) Includes all military aircraft (see Table 5-5).

(11) Values for Table 5-4 applied to user class categories.

SUPPORTING TABLES

UNIT REPLACEMENT AND RESTORATION COSTS OF DAMAGED AIRCRAFT

Table 5-9
Detail Supporting Table 5-1
Detail Commercial Aircraft Values
(Averages Weighted by Fleet)

	$ Millions					
Economic Values Class	**(Column 1) Average Aircraft Value**	**(Column 2) Minimum Value**	**(Column 3) Maximum Value**	**(Column 4) Standard Deviation**	**(Column 5) Restoration Cost**	**(Column 6) Fleet Size**
2 Engine Narrowbody Freight	4.83	1.31	8.04	1.47	0.65	28
737-200C	5.61	1.31	8.04	1.78	0.76	14
DC-9-30Fs	4.06	3.70	4.30	0.19	0.55	14
2 Engine Narrowbody Passenger	17.87	0.20	50.93	12.28	2.41	3,049
737-100 -7	0.50	0.50	0.50	0.00	0.07	14
737-100 -9	0.50	0.50	0.50	0.00	0.07	1
737-200 -17Q	5.80	5.80	5.80	0.00	0.78	1
737-200A-15	8.04	2.33	11.10	1.32	1.09	143
737-200A-17	7.61	5.60	11.20	1.43	1.03	25
737-200A-9	3.92	1.80	8.00	1.88	0.53	177
737-300	20.95	15.20	32.80	4.75	2.83	503
737-400	26.41	22.00	37.00	3.22	3.57	90
737-500	23.07	19.90	27.80	2.30	3.11	119
757-200	36.46	20.15	50.93	7.53	4.92	388
757-200EM	36.64	23.57	42.48	6.51	4.95	24
757-200PF	38.94	28.65	50.93	6.62	5.26	65
A320-200	31.53	25.50	40.48	4.04	4.26	121
BAC1-11s	0.20	0.20	0.20	0.00	0.03	24
DC-9-10s	1.10	1.10	1.10	0.00	0.15	71
DC-9-30 pax	3.46	2.80	6.00	0.84	0.47	358
DC9-21	1.10	1.10	1.10	0.00	0.15	5
DC9-41	3.27	2.10	5.07	0.90	0.44	42
DC9-51	4.69	4.01	5.85	0.49	0.63	62
F28-1000	1.53	1.02	1.96	0.37	0.21	10
F28-4000	3.15	2.35	3.84	0.61	0.43	23
Fokker F100	14.14	10.84	18.68	1.82	1.91	126
Fokker F70	16.17	15.02	16.56	0.77	2.18	4
MD-82 -217C	18.80	16.84	21.57	2.27	2.54	12
MD-82 217A	14.90	9.84	20.37	3.04	2.01	349
MD80-81	9.66	8.87	10.23	0.32	1.30	33
MD80-83	24.16	17.07	34.33	4.48	3.26	106
MD80-87	13.71	11.50	15.32	0.97	1.85	11
MD80-88	21.75	17.60	26.55	2.66	2.94	122
MD90-30	29.79	24.18	32.14	2.49	4.02	20
2 Engine Widebody Freight	51.15	6.00	83.50	26.54	6.91	66
767-300ERF	81.22	78.80	83.50	1.71	10.96	16
A300C4-203	6.00	6.00	6.00	0.00	0.81	1
A310-200f	24.28	21.50	27.02	1.79	3.28	30
A300-600 F4-605R	70.62	65.99	75.37	3.83	9.53	19
2 Engine Widebody Passenger	46.45	5.00	109.03	26.96	6.27	322
767-200/EM	23.40	20.59	25.65	1.06	3.16	55
767-200ER	40.64	31.19	68.66	8.93	5.49	37
767-300	49.56	40.70	63.09	7.53	6.69	26
767-300ER	69.40	57.10	85.50	7.60	9.37	92
777-200	102.95	98.44	109.03	4.37	13.90	21
A300-600R	46.93	42.38	58.27	4.96	6.34	38
A300B2-1C	6.59	6.59	6.59	0.00	0.89	1
A300B4-103	6.44	6.00	7.30	0.58	0.87	9
A300B4-200/2C	7.78	5.00	10.50	1.28	1.05	36
A310-200 pax	17.30	15.49	19.42	1.99	2.34	5
A310-300	30.10	30.10	30.10	0.00	4.06	1
A330-322	88.15	88.15	88.15	0.00	11.90	1
3 Engine Narrowbody Freight	3.17	1.05	12.00	2.15	0.43	285
727-100C/F -7	2.61	2.50	3.00	0.12	0.35	123
727-100C/F -7F	2.70	2.70	2.70	0.00	0.36	2
727-200F	2.91	1.05	5.34	1.18	0.39	149
727-200F -217	12.00	12.00	12.00	0.00	1.62	11

Table 5-9 (Continued)
Detail Supporting Table 5-1
Detail Commercial Aircraft Values
(Averages Weighted by Fleet)

	$ Millions					
Economic Values Class	**(Column 1) Average Aircraft Value**	**(Column 2) Minimum Value**	**(Column 3) Maximum Value**	**(Column 4) Standard Deviation**	**(Column 5) Restoration Cost**	**(Column 6) Fleet Size**
3 Engine Narrowbody Passenger	3.31	0.40	12.00	2.22	0.45	689
727-100 -217	6.60	6.60	6.60	0.00	0.89	3
727-100 -7	0.52	0.40	0.75	0.07	0.07	56
727-100 -9	0.70	0.55	0.85	0.15	0.09	3
727-100 TAY	9.80	9.80	9.80	0.00	1.32	44
727-200 -15V	3.00	3.00	3.00	0.00	0.41	1
727-200 -217V	12.00	12.00	12.00	0.00	1.62	2
727-200A-15	3.52	2.00	4.40	0.72	0.47	338
727-200A-17	4.52	2.00	5.50	0.51	0.61	66
727-200A-7	0.79	0.75	0.80	0.02	0.11	31
727-200A-9	1.79	0.81	2.94	0.60	0.24	145
3 Engine Widebody Freight	40.75	1.50	106.16	32.38	5.50	73
DC-10-10Fs	8.61	5.94	13.90	2.37	1.16	12
DC-10-30Fs	23.53	16.70	33.00	5.83	3.18	35
L1011-1F	1.50	1.50	1.50	0.00	0.20	1
L1011-200F	14.34	14.34	14.34	0.00	1.94	1
MD11-F	84.68	68.68	106.16	11.31	11.43	24
3 Engine Widebody Passenger	14.83	2.30	102.22	23.22	2.00	346
DC10-10	4.68	2.80	9.30	1.92	0.63	99
DC10-15	9.68	9.30	10.82	0.76	1.31	4
DC10-30	14.50	10.80	29.20	3.29	1.96	61
DC10-40	7.09	6.22	7.73	0.52	0.96	21
L1011-1/40s	3.26	2.30	5.20	0.83	0.44	57
L1011-100	4.81	3.80	6.50	1.12	0.65	11
L1011-200	7.19	5.62	8.37	1.19	0.97	11
L1011-250	14.13	13.82	14.76	0.48	1.91	6
L1011-50	4.06	3.59	5.77	0.49	0.55	21
L1011-500	9.51	8.50	9.80	0.44	1.28	19
MD11-P	81.32	67.74	102.22	7.17	10.98	36
4 Engine Narrowbody Freight	9.92	0.60	18.10	7.27	1.34	195
707-300C	0.60	0.60	0.60	0.00	0.08	10
707-300C SII	1.00	1.00	1.00	0.00	0.14	16
DC-8-50 Fs	1.75	1.75	1.75	0.00	0.24	12
DC-8-61Fs	2.40	2.40	2.40	0.00	0.32	15
DC-8-62Fs	3.00	3.00	3.00	0.00	0.41	25
DC-8-63Fs	7.46	6.19	9.04	0.65	1.01	25
DC-8-71Fs	16.50	16.50	16.50	0.00	2.23	44
DC-8-73Fs	18.10	18.10	18.10	0.00	2.44	48
4 Engine Narrowbody Passenger	4.50	0.10	25.23	2.80	0.61	108
707-100B JT3	0.20	0.20	0.20	0.00	0.03	1
707-100B JT3 SII	0.20	0.20	0.20	0.00	0.03	1
707-300pax	0.59	0.25	0.70	0.23	0.08	4
707-300pax SII	0.70	0.70	0.70	0.00	0.09	6
720s	0.10	0.10	0.10	0.00	0.01	5
Avro RJ85	25.23	25.23	25.23	0.00	3.41	1
BAe146-100	6.63	6.30	6.80	0.29	0.90	3
BAe146-200	9.50	8.40	12.10	1.08	1.28	17
BAe146-300	12.66	12.00	13.10	0.60	1.71	5
DC-8-50 pax	1.23	1.23	1.23	0.00	0.17	20
DC-8-63	4.75	4.75	4.75	0.00	0.64	15
DC8-61	2.20	2.20	2.20	0.00	0.30	11
DC8-62	2.80	2.80	2.80	0.00	0.38	15
DC8-71	12.50	12.50	12.50	0.00	1.69	1
DC8-72	10.00	10.00	10.00	0.00	1.35	2
DC8-73	14.00	14.00	14.00	0.00	1.89	1
4 Engine Widebody Freight	23.23	11.96	51.20	12.33	3.14	70
747-100F	13.09	11.96	16.73	1.00	1.77	39
747-200Fs	35.99	24.40	51.20	6.79	4.86	31

Table 5-9 (Continued)
Detail Supporting Table 5-1
Detail Commercial Aircraft Values
(Averages Weighted by Fleet)

	$ Millions					
Economic Values Class	**(Column 1) Average Aircraft Value**	**(Column 2) Minimum Value**	**(Column 3) Maximum Value**	**(Column 4) Standard Deviation**	**(Column 5) Restoration Cost**	**(Column 6) Fleet Size**
4 Engine Widebody Passenger	36.11	3.40	153.26	43.86	4.87	155
747-100pax	3.83	3.40	9.00	0.92	0.52	49
747-200B	18.42	8.40	32.70	7.68	2.49	58
747-200Combi	23.52	16.69	27.00	4.72	3.17	6
747-300	50.59	50.59	50.59	0.00	6.83	1
747-400	111.50	96.36	153.26	15.33	15.05	37
747-SP	6.07	5.33	6.52	0.57	0.82	4
Regional jet under 40 seats	NR	NR	NR	NR	NR	NR
Regional jet with 40-59 seats	15.98	14.06	18.14	1.35	2.16	72
Canadair CRJs	16.16	14.14	18.14	1.32	2.18	64
EMB-145	14.58	14.06	14.76	0.32	1.97	8
Regional Jet over 59 seats	NR	NR	NR	NR	NR	NR
Turboprops under 20 seats	1.75	0.20	4.53	1.27	0.24	929
1900C	1.94	1.28	2.51	0.44	0.26	160
1900D	3.80	2.89	4.53	0.42	0.51	202
Bandeirantes	0.58	0.47	0.78	0.08	0.08	44
Beech 99s	0.41	0.20	0.93	0.25	0.06	144
DHC6-100	0.44	0.37	0.48	0.04	0.06	22
DHC6-200	0.47	0.46	0.48	0.01	0.06	21
DHC6-300s	0.77	0.46	1.50	0.22	0.10	62
Do228	1.33	1.27	1.69	0.12	0.18	13
J31	0.92	0.52	1.40	0.16	0.12	131
J31/HP137 CENTURY3	0.20	0.20	0.20	0.00	0.03	2
J32	1.99	1.59	2.35	0.20	0.27	128
Turboprops under 20 seats Freight	0.88	0.75	1.07	0.07	0.12	242
CARAVAN	0.88	0.75	1.07	0.07	0.12	242
Turboprops with 20 or more seats	3.84	0.16	12.99	2.89	0.52	1,540
235-100	4.77	4.77	4.77	0.00	0.64	1
330-100	0.42	0.32	0.50	0.05	0.06	28
330-200	0.56	0.50	0.60	0.05	0.08	12
340A	2.63	2.09	3.50	0.35	0.36	91
340B	6.15	4.39	9.04	1.32	0.83	169
360-100	1.05	0.90	1.17	0.08	0.14	20
360-200	1.25	1.17	1.38	0.05	0.17	19
360-300	1.91	1.73	2.30	0.16	0.26	24
748-2B	0.78	0.78	0.78	0.00	0.11	2
ATP	5.57	4.16	7.30	0.85	0.75	14
ATR42-300s	5.94	4.48	7.84	0.86	0.80	96
ATR42-500	10.76	10.76	10.76	0.00	1.45	8
ATR72-200s	11.41	9.10	12.99	1.06	1.54	51
Brasilias	4.49	2.83	7.56	1.09	0.61	244
CASA 212s	0.57	0.28	0.85	0.15	0.08	38
Convair 580/600/640	0.50	0.50	0.50	0.00	0.07	89
DHC7	1.29	0.90	1.79	0.20	0.17	33
DHC8-100s	5.64	3.62	7.58	1.06	0.76	136
DHC8-200s	9.34	9.21	9.82	0.25	1.26	24
DHC8-300	6.90	6.58	7.21	0.45	0.93	2
Do328s	8.25	7.45	8.73	0.32	1.11	49
F27/FH227	0.60	0.20	2.39	0.71	0.08	78
J41	4.71	3.88	5.69	0.49	0.64	60
L188A	0.35	0.35	0.35	0.00	0.05	1
L188AF	0.80	0.80	0.80	0.00	0.11	7
L188C	0.70	0.70	0.70	0.00	0.09	6
L188CF	0.90	0.90	0.90	0.00	0.12	12
METRO 23	2.97	2.77	3.01	0.10	0.40	6
METRO 23 C26B	2.96	2.54	3.57	0.54	0.40	3
METRO II	0.31	0.16	0.50	0.08	0.04	68
METRO III	1.03	0.68	1.70	0.23	0.14	146
Saab 2000	11.95	11.95	11.95	0.00	1.61	3
Piston	NR	NR	NR	NR	NR	NR
Total	12.58	0.10	153.26	17.14	1.70	8,169

Source: GRA Aviation Specialists,Herndon, VA
Column 1: Average aircraft value
Column 2: Minimum value within the aircraft sample
Column 3: Maximum value within the aircraft sample
Column 4: Standard deviation of average aircraft value
Column 5: Column 1 multiplied by 13.5%
Column 6: Number of aircraft in fleet

Table 5-10
Detail Supporting Table 5-2
Representative General Aviation Average Aircraft Values
(Averages Weighted by Fleet)

Aircraft	(Column 1) Economic Value Class	(Column 2) Average Aircraft Value ($000)	(Column 3) Restoration Costs	(Column 4) Fleet Size
Piper Pa-28-140	1	25	7	4,540
Cessna 152	1	24	7	3,038
Cessna 150l	1	17	5	1,887
Cessna 150m	1	19	5	1,648
Piper Pa-18-150	1	44	13	1,432
Cessna 140	1	14	4	1,402
Aeronca 7ac	1	17	5	1,237
Cessna 150g	1	16	5	1,165
Cessna A188b	1	40	12	853
Cessna 172m	2	38	11	3,879
Cessna 172n	2	50	15	3,594
Piper Pa-28-180	2	35	10	3,320
Cessna 182p	2	62	18	2,007
Beech A36	2	172	50	1,913
Piper Pa-28-181	2	57	16	1,710
Mooney M20j	2	80	23	1,589
Cessna 172	2	25	7	1,561
Piper Pa-28r-200	2	46	13	1,559
Cessna 182q	2	78	23	1,508
Piper Pa-23-250	3	58	14	1,234
Beech 58	3	212	51	882
Piper Pa-30	3	50	12	853
Piper Pa-34-200t	3	91	22	735
Cessna 310r	3	131	31	600
Cessna 414a	3	320	77	594
Cessna 421c	3	335	80	529
Piper Pa-34-200	3	58	14	508
Antonov An-2	4	18	5	1
Cessna 402b	5	155	37	127
Cessna 402c	5	280	67	96
Beech D18s	5	59	14	61
Douglas Dc3c-R-1830-90c	6	163	39	23
Cessna 208b	8	910	149	242
Air Tractor Inc At-502	8	290	48	120
Ayres Corporation S2r-T34	8	225	37	106
Beech C90	9	635	104	404
Piper Pa-31t	9	560	92	234
Beech 65-90	9	325	53	115
Pilatus Aircraft Ltd Pc-12	10	2,100	344	13
Cessna 208	10	905	148	12
Beech 200	11	1,050	172	382
Beech B200	11	1,775	291	310
Beech E-90	11	705	116	162
Cessna 441	11	1,050	172	162
Cessna 425	11	925	152	141
Jetstream 4101	12	4,690	769	47
Embraer Emb-110p1	12	1,055	173	39
Cessna 550	14	1,900	312	302
Cessna 560	14	4,200	689	241
Gates Learjet Corp. 35a	14	2,600	426	240
Cessna 501	14	1,305	214	211
Cessna 650	14	5,300	869	208
Gulfstream Aerospace G-Iv	15	21,000	3,444	268
Canadair Ltd Cl-600-2b16	15	14,150	2,321	160
Hawker Siddeley Hs.125 Series 700a	15	3,100	508	93
Dassault-Breguet Falcon 50	17	9,550	1,566	90
Dassault-Breguet Mystere Falcon N 900	17	18,700	3,067	56
Lockheed 1329-25 Jetstar Ii	17	2,200	361	29
Boeing 727-44	18	2,000	328	27
BAE/Bac 1-11 401/Ak	18	1,500	246	27
Dassault Aviation Falcon 2000	18	18,000	2,952	25
Robinson Helicopter R22 Beta	19	82	24	397
Hughes 269c	19	86	25	174
Hiller Uh-12e	19	50	15	82
Bell 206b	20	405	97	1,056
Hughes 369d	20	315	76	189
Bell Helicopter Textron 206l-1	20	495	119	152
McDonnell Douglas Helicopter 3 69e	20	500	120	122
Enstrom F-28c	21	70	20	14
Bell 206l-3	22	720	173	219
Bell 214st	22	4,760	1,142	132

Source: *Aircraft Bluebook Price Digest* (Spring 1997), *op. cit* . and detailed data from

General Aviation and Air Taxi Activity and Avionics Survey, Calendar Year 1995 , *op. cit.*

Col 1: Economic Values Class aircraft is assigned based on characteristics published in GA Survey.

Col 2: Value for average aircraft of this type as identified in the Bluebook.

Col 3: Values from Table 5-4 multiplied by column 2

Col 4: Number of aircraft in active fleet as identified in the GA Survey.

Table 5-11
Detail Supporting Table 5-6
Average Military Aircraft Values By Type
(Averages Weighted by Fleet)

Type	(Column 1) Number in Fleet (12/96)	(Column 2) Estimated Aircraft Value ($000,000)	(Column 3) Restoration Costs ($000,000)
Boeing B-52H	94	$21.2	$2.86
Northrop Grumman B-2A	15	$939.4	$126.82
Rockwell B-1B	95	$178.6	$24.11
Lockheed C-141B	144	$66.5	$8.98
Lockheed C-5A	84	$53.7	$7.25
Lockheed C-5B	50	$151.8	$20.49
McDonnell Douglas C-17A	22	$135.8	$18.33
McDonnell Douglas KC-10A	59	$87.3	$11.78
Boeing C-135A/B/C/E	15	$66.5	$8.98
Boeing EC-135	15	$66.5	$8.98
Boeing KC-135E/R	551	$66.5	$8.98
Boeing RC-135	19	$66.5	$8.98
Boeing E-3B/C	34	$167.9	$22.66
Boeing E-6A	16	$174.6	$23.57
OTHER	37	$66.5	$8.98
Turbojet/fan 3+ engines	1250	$91.0	$12.28
McDD/BA AV-8B Harrier 2	201	$40.9	$5.52
McDonnell Douglas F/A-18	1039	$57.8	$7.80
Fairchild A-10A	380	$10.7	$1.45
Lock Martin F-16A/B	225	$20.7	$2.79
Lock Martin F-16C/D	1039	$20.7	$2.79
Lockheed F-117A	52	$54.7	$7.38
McDonnell Douglas F-15A/B/C/D	726	$26.9	$3.63
McDonnell Douglas F-15E	204	$39.3	$5.31
Gen Dyn F-111	135	$7.5	$1.02
Grumman F-14	361	$43.9	$5.93
McDonnell Douglas F-4	196	$4.8	$0.65
McDonnell Douglas T-45A	44	$26.4	$3.56
Northrop F-5	45	$6.7	$0.91
OTHER	16	$25.2	$3.40
Turbojet/fan Attack/Fighter	4663	$31.9	$4.30
Gulfstream C-20	20	$29.0	$3.92
Learjet C-21	83	$5.6	$0.76
McDonnell Douglas C-9A/C	52	$29.0	$3.92
Rockwell CT-39E/G Sabreliner	12	$5.2	$0.70
Rockwell T-39	23	$5.2	$0.70
Grumman A-6	185	$33.6	$4.53
Lockheed U-2R/RT	37	$32.2	$4.35
Boeing T-43A	14	$10.1	$1.36
McDonnell Douglas TAV-8B	17	$28.7	$3.88
Raytheon T-1A	132	$5.4	$0.73
Rockwell T-2B/C	111	$0.7	$0.09
Cessna T-37B	488	$0.3	$0.05
Northrop T-38	497	$2.7	$0.36
OTHER	3	$7.8	$1.06
Turbojet/fan Other	1674	$7.8	$1.06

Type	(Column 1) Number in Fleet (12/96)	(Column 2) Estimated Aircraft Value ($000,000)	(Column 3) Restoration Costs ($000,000)
Alenia c-27A	10	$28.9	$3.91
Beech T-34C	272	$1.6	$0.22
Beech T-42A	14	$28.9	$3.91
Beech U-8F	48	$28.9	$3.91
Grumman C-2A	38	$28.2	$3.81
Grumman E-2C	91	$70.9	$9.57
Grumman OV-1D	59	$0.7	$0.09
Lock Martin C-130 A-E	622	$44.3	$5.98
Lock Martin C-130-OTHER	91	$44.3	$5.98
Lockheed ES-3A	16	$28.9	$3.91
Lockheed Martin KC-130F/R/T	183	$42.3	$5.71
Lockheed Martin P-3C	263	$51.2	$6.91
Lockheed S-3B	119	$20.1	$2.72
Raytheon C-12	199	$3.8	$0.51
Raytheon RC-12	134	$3.8	$0.51
Raytheon RU-21	107	$3.8	$0.51
Raytheon T-44A	57	$2.2	$0.29
OTHER	48	$28.9	$3.91
Turboprop	2371	$29.7	$4.00
Slingsby T-3A//Piston	91	$0.1	$0.02
Bell AH-1E/F/F/P/S	929	$12.3	$1.66
Bell AH-1W	140	$12.3	$1.66
Bell HH-1H	58	$2.7	$0.36
Bell OH-58A-C	1517	$8.6	$1.16
Bell OH-58D	289	$8.6	$1.16
Bell TH-57	129	$8.4	$1.13
Bell TH-67A	82	$8.4	$1.13
Bell UH-1B/H/V	2872	$0.6	$0.08
Bell UH-1N	159	$0.6	$0.08
Boeing CH-46	499	$4.6	$0.62
Boeing CH-47C/D	430	$17.5	$2.36
Hughes OH-6A	229	$0.3	$0.04
Kaman SH-2F/G	26	$8.1	$1.09
McDonnell Douglas AH-64A	755	$11.0	$1.49
McDonnell Douglas AH-6C/G	60	$0.3	$0.04
Sikorsky CH-53D	496	$26.5	$3.57
Sikorsky SH-3H	40	$1.3	$0.18
Sikorsky SH-60B	1617	$13.8	$1.86
Sikorsky VH-3D11	11	$8.4	$1.13
Other	16	$8.4	$1.13
Rotary Aircraft total	10354	$8.4	$1.13

Sources: See text at section 5.4.1

Column 1: Estimated number of each aircraft type in military service

Column 2: Estimated value per aircraft

Column 3: Average restoration value- Column 2 value multiplied by 13.5 percent